Hektoria Glacier Collapse: A One-Page Policy Brief

What Antarctica's fastest-retreating glacier (2018–2024) tells decision-makers

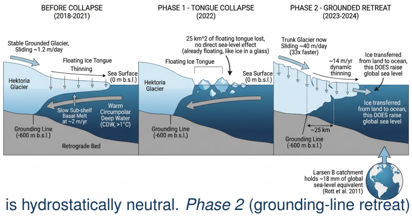

Figure 1. Two-phase collapse on a retrograde bed. *Phase 1* (tongue loss) is hydrostatically neutral. *Phase 2* (grounding-line retreat) transfers land ice into the ocean and *directly* raises global sea level.

What happened, in plain English

Between 2018 and 2024, Hektoria Glacier on the eastern Antarctic Peninsula underwent the **fastest grounded-ice retreat ever observed in Antarctica** from space [1]. It happened in two phases that matter very differently for global sea level.

Phase 1 (2022) — the floating tongue broke up. Hektoria's seaward end was a floating ice "tongue" — ice already in the water, held in place by surrounding sea ice. When landfast sea ice in the former Larsen B embayment disappeared in early 2022, the tongue calved away over a few months. *Losing a floating tongue does not directly raise sea level* — like ice melting in a glass, that ice was already displacing its weight in seawater.

Phase 2 (2023–2024) — the grounded glacier ran away. With its floating extension gone, the trunk of the glacier — ice that was sitting on bedrock — sped up from ∼1 m/day to ∼40 m/day, thinned at ∼14 m per year, and its grounding line (where ice lifts off the bed and floats) retreated ∼25 km inland in a single year [1]. *This grounded ice is the part that raises global sea level* when it discharges into the ocean.

Hektoria's bed makes the situation worse: it slopes the wrong way. The bedrock under the glacier gets *deeper* as you move inland (from −600 m at the 2018 grounding line to −780 m by 2024) [2,1]. This "retrograde" geometry removes the natural braking force that would normally stop a retreat. Coupled with ocean-driven sub-shelf melt from warm Circumpolar Deep Water that pre-thinned the tongue at ∼2–10 m/yr through 2018–2021 [3,4], this configuration explains why the retreat, once triggered, did not stop.

Two phases → measurable sea-level rise

A city planner can think of the translation in three steps:

1. **Identify ice above flotation.** BedMachine Antarctica [2] separates the part of the ice column sitting *above* the level at which it would float. Only that portion contributes to global sea level.
2. **Convert mass to sea-level equivalent (SLE).** Each ∼361.8 Gt of land ice discharged or melted raises global mean sea level by about 1 mm [5].
3. **Aggregate across the catchment.** The full Larsen B catchment (Hektoria, Green, Evans, Jorum, Crane) holds roughly **18 mm** of global sea-level equivalent in grounded ice [6]. Hektoria's 2023–2024 retreat alone — a 33× speed-up against ∼14 m/yr thinning over a 25 km path — registers in continental mass-balance products like IMBIE [5].

The signal in any single year is small, but the *rate* is unprecedented. The Antarctic Peninsula is not, by itself, a multi-metre sea-level threat. **The lesson is that an ice-plain-on-retrograde-bed geometry can collapse within *two years***, not the decades or centuries assumed in earlier risk models [7]. The same geometry exists — and is now being monitored — under much larger West Antarctic systems whose SLE is measured in *metres*.

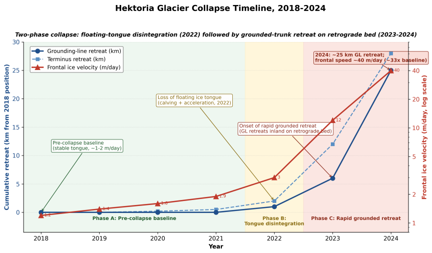

Figure 2. Labelled retreat timeline, 2018–2024. Cumulative grounding-line and terminus retreat (left axis, linear) and frontal ice velocity (right axis, log scale). Sources: Christie et al. [1], Rott et al. [8], Sentinel-1 [9], Surawy-Stepney et al. [10]. Phase A: pre-collapse baseline; Phase B: 2022 tongue disintegration; Phase C: 2023–2024 rapid grounded retreat.

Three Antarctic Peninsula glaciers with similar at-risk geometry

Glacier	Location & geometry	Bed at GL, '18→'24	Speed, m/day	Why it matters
Hektoria	E. AP, Larsen B; tongue + retrograde plain	−600→ −780 m	1.2→40 (33×)	Reference case; record-setting retreat
Crane	E. AP, Larsen B (S. of Hektoria); tongue lost 2002	−700→ −900 m	4.0→5.5 (1.4×)	Mature post-tongue-loss state; deepest bed [6,8]
Jorum	E. AP, immediately S. of Hektoria; same embayment	−550→ −700 m	1.1→12 (11×)	Collapsing *synchronously* with Hektoria, 2022–2024 [1]
Cadman	W. AP, Marguerite Bay; tongue collapsed 2018–2021	−350→ −450 m	1.5→3.0 (2×)	Independent W. AP confirmation: same mechanism [11]

Table 1. Four Antarctic Peninsula glaciers that share Hektoria's vulnerability signature (floating tongue + retrograde bed + ocean-driven sub-shelf melt + lost buttress). Literature-derived best estimates [1,2,6,8,10,11]; *GL* = grounding line; depths are bed elevation below sea level.

What policy actions follow

- **Near-term hazard, not 21st-century one.** Hektoria went from stable to fully ungrounded in ∼2 years; coastal planning must accept *event-driven* Antarctic contributions.
- **Fund continuous monitoring of analogues.** Crane, Jorum, Cadman share Hektoria's signature (Table 1). Sentinel-1 [9] catches tongue loss; ITS_LIVE [12] flags the speed-up.
- **Separate the two phases in messaging.** Phase 1 (tongue calving) is not a sea-level event; Phase 2 (grounded retreat) is. Conflating them erodes public trust.
- **Extend the framework to West Antarctica.** Naughten et al. [4]: Amundsen Sea cavity warming is now committed — Hektoria's geometry is being primed under much larger basins.

Data and models used in this brief. Satellite & velocity: Copernicus Sentinel-1 SAR; NASA ITS_LIVE (NSIDC MEaSUREs) [9,12]. **Bed:** BedMachine Antarctica v3 [2]. **Ocean melt:** Naughten et al. [4], Cook et al. [3]. **Mass balance:** IMBIE [5]. **Sea-ice / mélange:** Benn et al. [7].

ML / open-science repositories. The Hugging Science community on Hugging Face [13] curates open AI-for-science benchmarks. For Earth observation, IBM–NASA's Prithvi geospatial foundation model [14] and ESA's Major TOM Sentinel collections provide ML-ready imagery for calving-front and grounding-line detection. *As of this brief, no Hugging Face dataset covers Hektoria-specific velocity or grounding-line products for 2018–2024; primary observational data remain on NSIDC, NASA Earthdata, and ESA archives.*

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